Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A method of optimizing a painting process for applying a paint layer on an article, the painting process controlled by a set of paint processing parameters, the method comprising:

a) defining a functional relationship between the set of paint processing parameters and a paint layer property with a neural network having one or more neutral layers to the one or more neural layers comprising a plurality of neural units having a plurality of neural network parameters,

b) forming a paint optimization function that ~~measures the efficiency of the painting process~~ measures a combination of quality control parameters and paint transfer efficiency, the paint optimization function being a function of the paint layer property; and

c) optimizing the paint optimization function by adjusting the one or more paint processing parameters utilizing the functional relationship defined in step a, wherein the functional relationship is defined by:

obtaining a plurality of groups of values P_k for the set of paint processing parameters and a value V for the paint layer property for each of the plurality of groups of values P_k wherein k is an index number for each of the paint processing parameters with values from 1 to the number of processing parameters; and

operating on each of the plurality of groups of values P_k for the set of paint processing parameters with the neural network to provide an output O for each of the plurality of groups of values P_k; and

adjusting the plurality of neural network parameters to minimize the differences between the output O and the value V for each of the one or more groups of values for a set of paint processing parameters to give a plurality of adjusted neural network parameters.

2. (Cancelled)

3. (Currently Amended) The method of ~~claim 2~~ claim 1 wherein the step of operating on each of the plurality of groups of values P_k and the step of adjusting the plurality of neural network parameters is performed on a computer.

4. (Currently Amended) The method of ~~claim 2~~ claim 1 wherein the neural network operates on the plurality of groups of values P_k through a first neural layer defined by equation 1 to give a first set of outputs ai:

$$a^i = f^1(W^1_{i,k}P_k + b^1_i) \qquad 1$$

the outputs ai being operated on by a second neural layer defined by equation 2 to give outputs O

$$O = f^2(W^2_{j,k}P_k + b^2_j) \qquad 2$$

wherein f^1 is a transfer function for the first neural layer, f^2 is a transfer function for the second neural layer, i is an index number with values from 1 to the number of neurons in the first neural layer, j is an index number with values from 1 to the number of neurons in the second neural layer, $W^1_{i,k}$ are adjustable neural network parameters for the first layer, $W_{2i,k}$ are adjustable neural network parameters for the second neural layer, b^1_i are bias factors for the first neural layer, and b^2_j are bias factors for the second neural layer.

5. (Currenty Amended) The method of ~~claim 2~~ claim 1 wherein the paint optimization function is given by ~~equation 4~~:

$$J = \alpha\Sigma(FB-FT)^2 + (1 - \alpha)(\Sigma\ FF/\Sigma FB) \qquad \text{~~(4)~~}$$

wherein FB is an average thickness calculated from the functional relationship, FT is a target average film thickness, FF is the amount of paint sprayed, α is a weighting factor with a value between 0 and 1.

6. (Original) The method of claim 1 wherein the paint layer property is the average thickness of the paint layer within a region of the article.

7. (Currently Amended) The method of claim 1 wherein one or more paint processing parameters are selected from the group consisting of applicator parameters, environmental parameters, applicator position parameters, paint material parameters, and combinations ~~thereof~~ of the above.

8. (Currently Amended) The method of claim 7 wherein the applicator parameters are selected from the group consisting of fluid flow rates, shaping air flow rates, bell speeds, high voltage setting, and combinations ~~thereof~~ of the above.

9. (Currently Amended) The method of claim 7 wherein the environmental parameters are selected from the group consisting of air downdrafts in the reciprocator zones, air downdrafts in the bell zone, air temperature, air humidity, and combinations ~~thereof~~ of the above.

10. (Currently Amended) The method of claim 7 wherein the applicator position parameters are selected from the group consisting of target distance, angle to target, bell position, oscillation speed, oscillation stroke, bell separation, and combinations ~~thereof~~ of the above.

11. (Currently Amended) The method of claim 7 wherein the paint material properties are selected from the group consisting of paint viscosity, paint temperature, paint resistivity, and combinations ~~thereof~~ of the above.

12. (Currently Amended) The method of claim 7 wherein one or more paint processing parameters are selected from the group consisting of average fluid flow rate, downdrafts at the bell zones, downdrafts at the reciprocator zones, air temperature, air humidity, and combinations ~~thereof~~ of the above.

13. (Original) The method of claim 1 wherein the step of optimizing the paint optimization function is performed on a computer.

14. (Currently Amended) A method of optimizing a painting process for applying a paint layer on an article, the painting process controlled by a set of paint processing parameters, the method comprising:

a) obtaining a plurality of groups of values P_k for the set of paint processing parameters and a value V for the paint layer property for each of the plurality of groups of values P_k wherein k is an index number for each of the paint processing parameters with values from 1 to the number of processing parameters; and

b) defining a functional relationship between the set of paint processing parameters and a paint layer property by operating on each of the plurality of groups of values P_k for the set of paint processing parameters with a neural network having one or more neural layer to provide an output O for each of the plurality of groups of values P_k, the one or more neural layers comprising a plurality of neural units having a plurality of neural network parameters;

c) adjusting the plurality of neural network parameters to minimize the differences between the output O and the value V for each of the one or more groups of values for a set of paint processing parameters to give a plurality of adjusted neural network parameters;

d) forming a paint optimization function that ~~measures the efficiency of the painting process~~ measures a combination of quality control parameters and paint transfer efficiency, the paint optimization function being a function of the paint layer property; and

e) optimizing the paint optimization function by adjusting the one or more paint processing parameters utilizing the functional relationship defined in step d, wherein the neural network operates on a plurality of groups of values P_k through a first neural layer to give a first set of outputs a_i:

$$a_i = f^1(W^1_{i,k} P_k + b^1_i)$$

the outputs a_i being operated on by a second neural layer to give outputs O

$$O = f^2(W^2_{j,k}P_k + b^2_j)$$

wherein f^1 is a transfer function for the first neural layer, f^2 is a transfer function for the second neural layer, i is an index number with values from 1 to the number of neurons in the first neural layer, j is an index number with values from 1 to the number of neurons in the second neural layer, $W^1_{i,k}$ are adjustable neural network parameters for the first layer, $W^2_{i,k}$ are adjustable neural network parameters for the second neural layer, b^1_i are bias factors for the first neural layer, and b^2_j are bias factors for the second neural layer.

15. (Cancelled)

16. (Currently Amended) The method of ~~claim 15~~ claim 14 wherein the paint optimization function is given by ~~equation 4~~:

$$J = \alpha\Sigma(FB-FT)^2 + (1 - \alpha)(\Sigma FF/\Sigma FB) \qquad \text{~~(4)~~}$$

wherein FB is an average thickness calculated from the functional relationship, FT is a target average film thickness, FF is the amount of paint sprayed, and a is a weighting factor with a value between 0 and 1.

17. (Original) The method of claim 16 wherein the optimization function given by J is minimized during the step of optimization.

18. (Original) The method of claim 16 wherein one or more paint processing parameters are selected from the group consisting average fluid flow rate, downdrafts at the bell zones, downdrafts at the reciprocator zones, air temperature, air humidity, and combinations thereof.

19. (Currently Amended) A system for optimizing a painting process for applying a paint layer on an article, the painting process controlled by a set of paint processing parameters, the system comprising a computer configured to:

define a functional relationship with a neural network having one or more neutral layers between the set of paint processing parameters and a paint layer property, the one or more neural layers comprising a plurality of neural units having a plurality of neural network parameters; and

optimize a paint optimization function that ~~measures the efficiency of the painting process~~ measures a combination of quality control parameters and paint transfer efficiency, by adjusting the one or more paint processing parameters, the paint optimization function being a function of the paint layer property, wherein the functional relationship is defined by:

obtaining a plurality of groups of values P_k for the set of paint processing parameters and a value V for the paint layer property for each of the plurality of groups of values P_k wherein k is an index number for each of the paint processing parameters with values from 1 to the number of processing parameters; and

operating on each of the plurality of groups of values P_k for the set of paint processing parameters with the neural network to provide an output O for each of the plurality of groups of values P_k; and

adjusting the plurality of neural network parameters to minimize the differences between the output O and the value V for each of the one or more groups of values for a set of paint processing parameters and wherein the neural network operates on a plurality of groups of values P_k through a first neural layer to give a first set of outputs a_i:

$$a_i = f^1(W^1_{i,k} P_k + b^1_i)$$

the outputs a_i being operated on by a second neural layer to give outputs O

$$O = f^2(W^2_{j,k} P_k + b^2_j)$$

wherein f^1 is a transfer function for the first neural layer, f^2 is a transfer function for the second neural layer, i is an index number with values from 1 to the number of neurons in the first neural layer, j is an index number with values from 1 to the number of neurons in the second neural layer, $W^1_{i,k}$ are adjustable neural network parameters for the first layer, $W^2_{i,k}$ are adjustable neural network parameters for the second neural layer, b^1_i are bias factors for the first neural layer, and b^2_j are bias factors for the second neural layer.

20. (Cancelled)

21. (Currently Amended) The system of ~~claim 20~~ claim 19 wherein the neural network operates on a plurality of groups of values P_k through a first neural layer to give a first set of outputs a_i:

$$a_i = f^1(W^1_{i,k}P_k + b^1_i)$$

the outputs a_i being operated on by a second neural layer to give outputs O

$$O = f^2(W^2_{j,k}P_k + b^2_j)$$

wherein f^1 is a transfer function for the first neural layer, f^2 is a transfer function for the second neural layer, i is an index number with values from 1 to the number of neurons in the first neural layer, j is an index number with values from 1 to the number of neurons in the second neural layer, $W^1_{i,k}$ are adjustable neural network parameters for the first layer, $W^2_{i,k}$ are adjustable neural network parameters for the second neural layer, b^1_i are bias factors for the first neural layer, and b^2_j are bias factors for the second neural layer.

22. (Original) The system of claim 19 wherein the paint layer property is the average thickness of the paint layer within a region of the article.

23. (Original) The system of claim 19 wherein one or more paint processing parameters are selected from the group consisting of applicator parameters, environmental parameters, applicator position parameters, paint material parameters, and combinations thereof.

24. (Original) The system of claim 19 wherein one or more paint processing parameters are selected from the group consisting of average fluid flow rate, downdrafts at the bell zones, downdrafts at the reciprocator zones, air temperature, air humidity, and combinations thereof.

25. (Currently Amended) The system of claim 19 wherein the paint optimization function is given by ~~equation 4~~:

$$J = \alpha\Sigma(FB-FT)^2 + (1 - \alpha)(\Sigma\ FF/\Sigma FB) \qquad \text{~~(4)~~}$$

wherein FB is an average thickness calculated from the functional relationship, FT is a target average film thickness, FF is the amount of paint sprayed, and α is a weighting factor with α value between 0 and 1.